

- 1 1. A solid-state battery, comprising:
2 a plurality of stacked thin film layers,
3 wherein the solid-state battery is at least partially integrated within the stacked layers and
4 has a thickness less than about 1 μm .
- 1 2. The solid-state battery of claim 1 wherein the stacked thin film layers comprise a cathode
2 layer, an electrolyte layer, and an anode layer.
- 1 3. The solid-state battery of claim 2 wherein (i) the electrolyte layer is disposed proximate
2 the cathode layer, the electrolyte layer having a first surface contacting the cathode layer; and (ii)
3 the anode layer is disposed proximate the electrolyte layer, the anode layer contacting a second
4 surface of the electrolyte layer.
- 1 4. The solid-state battery of claim 2 wherein the electrolyte comprises silicon dioxide.
- 1 5. The solid-state battery of claim 4 wherein the electrolyte is substantially free of lithium.
- 1 6. The solid-state battery of claim 4 wherein the electrolyte layer has a thickness less than
2 about 100 nm.
- 1 7. The solid-state battery of claim 2 wherein at least one of the anode and cathode
2 comprises silicon.
- 1 8. The solid-state battery of claim 2 wherein at least one of the anode and the cathode
2 comprises lithium.
- 1 9. The solid state battery of claim 8 wherein at least one of the anode and the cathode
2 comprises at least one of a lithium-metal alloy, a III-V compound, a II-VI compound, a nitride,
3 lithium intercalated into graphite, and an oxide.
- 1 10. The solid-state battery of claim 9 wherein at least one of the anode and the cathode
2 comprises at least one of $\text{Li}_{12}\text{Sn}_5$, LiCoO_2 , titanium nitride, nickel silicide, cobalt silicide,
3 titanium oxide, and a transition metal oxide.

- 1 11. The solid-state battery of claim 2 wherein the cathode layer has a thickness less than
2 about 500 nm.
- 1 12. The solid-state battery of claim 2 wherein the anode layer has a thickness less than about
2 500 nm.
- 1 13. The solid-state battery of claim 1 wherein the stacked layers are formed on a substrate,
2 and at least a portion of the substrate comprises at least a portion of the solid-state battery.
- 1 14. The solid-state battery of claim 13 wherein the substrate comprises an anode.
- 1 15. The solid-state battery of claim 13 wherein the substrate comprises a cathode.
- 1 16. The solid-state battery of claim 1 wherein the battery is integrated within and operatively
2 connected to an integrated circuit defined on the substrate.
- 1 17. The solid-state battery of claim 1, further comprising:
2 a contact layer disposed over the battery.
- 1 18. A method for forming a solid-state battery, comprising the steps of:
2 forming a plurality of thin film layers over a substrate; and
3 patterning the plurality of thin film layers to define the solid-state battery,
4 wherein the solid-state battery has a thickness less than approximately 1 μm .
- 1 19. The method of claim 18 wherein the plurality of thin film layers includes a cathode layer,
2 an electrolyte layer, and an anode layer.
- 1 20. The method of claim 19 wherein the electrolyte layer comprises silicon dioxide.
- 1 21. The method of claim 20 wherein forming the electrolyte layer comprises at least one of
2 dry oxidation and wet oxidation.
- 1 22. The method of claim 20 wherein the electrolyte layer has a thickness less than
2 approximately 500 nm.
- 1 23. The method of claim 18 wherein forming the layers comprises sputtering.

- 1 24. The method of claim 18 wherein forming the layers comprises chemical vapor
2 deposition.
- 1 25. The method of claim 18 wherein patterning the layers comprises photolithography.
- 1 26. The method of claim 18 wherein patterning the layers comprises etching.
- 1 27. The method of claim 18 wherein the solid-state battery is integrated within and
2 operatively connected to an integrated circuit disposed on the substrate
- 1 28. A solid-state battery, comprising:
2 a plurality of stacked thin film layers,
3 wherein the solid-state battery is at least partially integrated within the stacked thin film
4 layers, the stacked thin film layers comprise an electrolyte layer and the electrolyte layer has a
5 thickness of less than about 100 nm.
- 1 29. The solid-state battery of claim 28 wherein the stacked thin film layers further comprise a
2 cathode layer and an anode layer.
- 1 30. The solid-state battery of claim 29 wherein (i) the electrolyte layer is disposed proximate
2 the cathode layer, the electrolyte layer having a first surface contacting the cathode layer; and (ii)
3 the anode layer is disposed proximate the electrolyte layer, the anode layer contacting a second
4 surface of the electrolyte layer.
- 1 31. The solid-state battery of claim 29 wherein the electrolyte comprises silicon dioxide.
- 1 32. The solid-state battery of claim 29 wherein the electrolyte is substantially free of lithium.
- 1 33. The solid-state battery of claim 31 wherein the electrolyte layer has a thickness less than
2 about 10 nm.
- 1 34. The solid-state battery of claim 29 wherein at least one of the anode and cathode
2 comprises silicon.
- 1 35. The solid-state battery of claim 29 wherein at least one of the anode and the cathode
2 comprises lithium.

- 1 36. The solid state battery of claim 35 wherein at least one of the anode and the cathode
2 comprises at least one of a lithium-metal alloy, a III-V compound, a II-VI compound, a nitride,
3 lithium intercalated into graphite, and an oxide.
- 1 37. The solid-state battery of claim 36 wherein at least one of the anode and the cathode
2 comprises at least one of $\text{Li}_{22}\text{Sn}_5$, LiCoO_2 , titanium nitride, nickel silicide, cobalt silicide,
3 titanium oxide, and a transition metal oxide.
- 1 38. The solid-state battery of claim 29 wherein the cathode layer has a thickness less than
2 about 500 nm.
- 1 39. The solid-state battery of claim 29 wherein the anode layer has a thickness less than
2 about 500 nm.
- 1 40. The solid-state battery of claim 28 wherein the stacked layers are formed on a substrate,
2 and at least a portion of the substrate comprises at least a portion of the solid-state battery.
- 1 41. The solid-state battery of claim 40 wherein the substrate comprises an anode.
- 1 42. The solid-state battery of claim 40 wherein the substrate comprises a cathode.
- 1 43. The solid-state battery of claim 28 wherein the battery is integrated within and
2 operatively connected to an integrated circuit defined on the substrate.
- 1 44. The solid-state battery of claim 28 further comprising:
2 a contact layer.
- 1 45. A method for forming a solid state battery, comprising the steps of:
2 forming a plurality of thin film layers over a substrate, and
3 chemical mechanical polishing at least one of the thin film layers.
- 1 46. A method for forming a solid-state battery, comprising the steps of:
2 forming a plurality of thin film layers over a substrate; and
3 patterning the plurality of thin film layers to define the solid-state battery, the solid-state
4 battery including an electrolyte layer,

- 5 wherein the electrolyte layer has a thickness of less than about 100 nm.
- 1 47. The method of claim 46 wherein the plurality of thin film layers includes a cathode layer
2 and an anode layer.
- 1 48. The method of claim 46 wherein the electrolyte layer comprises silicon dioxide.
- 1 49. The method of claim 48 wherein forming the electrolyte layer comprises at least one of
2 dry oxidation and wet oxidation.
- 1 50. The method of claim 48 wherein the electrolyte layer has a thickness less than
2 approximately 10 nm.
- 1 51. The method of claim 46 wherein forming the layers comprises sputtering.
- 1 52. The method of claim 46 wherein forming the layers comprises chemical vapor
2 deposition.
- 1 53. The method of claim 46 wherein patterning the layers comprises photolithography.
- 1 54. The method of claim 46 wherein patterning the layers comprises etching.
- 1 55. The method of claim 46 wherein the solid-state battery is integrated within and
2 operatively connected to an integrated circuit disposed on the substrate
- 1 56. The method of claim 46 wherein at least one of the thin film layer comprises polysilicon.
- 2 57. A solid-state battery, comprising:
3 a thin solid electrolyte layer,
4 wherein the electrolyte layer comprises an initial state and an operative state, the
5 electrolyte layer in the initial state is substantially free of ions, and ions conduct through the
6 electrolyte layer in the operative state during operation of the battery.